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Akuta

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(54) **TERMINAL BLOCK**

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(51) **Int. Cl.**

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H01R 9/18	(2006.01)
H01R 9/24	(2006.01)
H01R 11/12	(2006.01)

(52) **U.S. Cl.**

CPC .. ***H01R 9/18*** (2013.01); ***H01R 4/30*** (2013.01); ***H01R 9/24*** (2013.01); *H01R 11/12* (2013.01)

(58) **Field of Classification Search**

CPC H01R 9/18; H01R 9/24; H01R 4/30; H01R 4/34; H01R 9/223; H01R 9/26; H01R 4/2429; H01R 9/22; H01R 12/515; H01R 9/2416; H01R 9/2675

See application file for complete search history.

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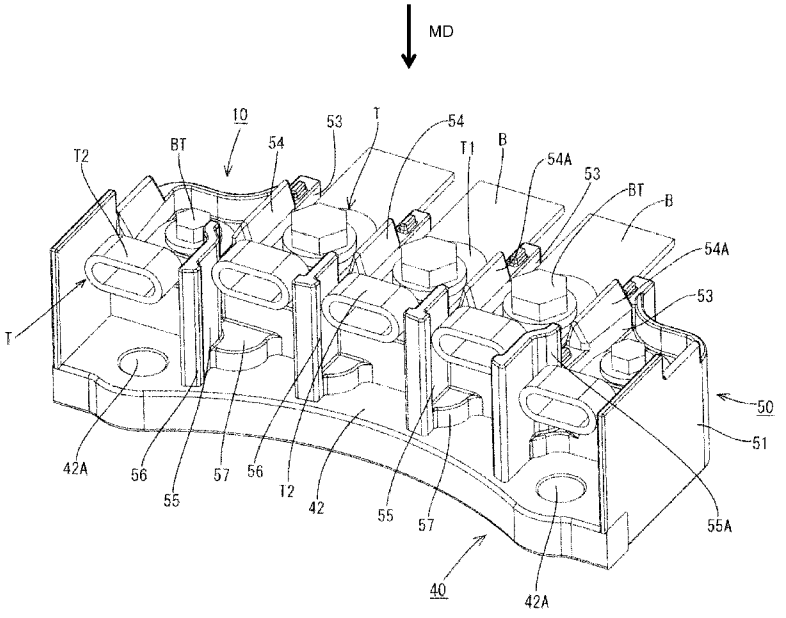
(57) **ABSTRACT**

A terminal block (**10**) is for connecting terminals (T) connected to enameled wires extending from a motor and busbars (B) extending from an inverter and includes a plurality of nuts (**20**) arranged in a width direction and configured to fasten the terminals (T) and the busbars (B) together with bolts (BT), guides (**54**) are provided between adjacent nuts (**20**) and configured to guide bolt fastening portions (T**1**) of the terminals (T) to the upper surfaces of the nuts by coming into contact with lateral edge parts of the terminals (T), and posture correcting portions (**55**) provided at positions where the terminals (T) are pulled out backward from the nuts and configured to correct postures of barrel portions (T**2**) of the terminals (T) in the width direction by contacting the barrels (T**2**) in the width direction.

8 Claims, 18 Drawing Sheets



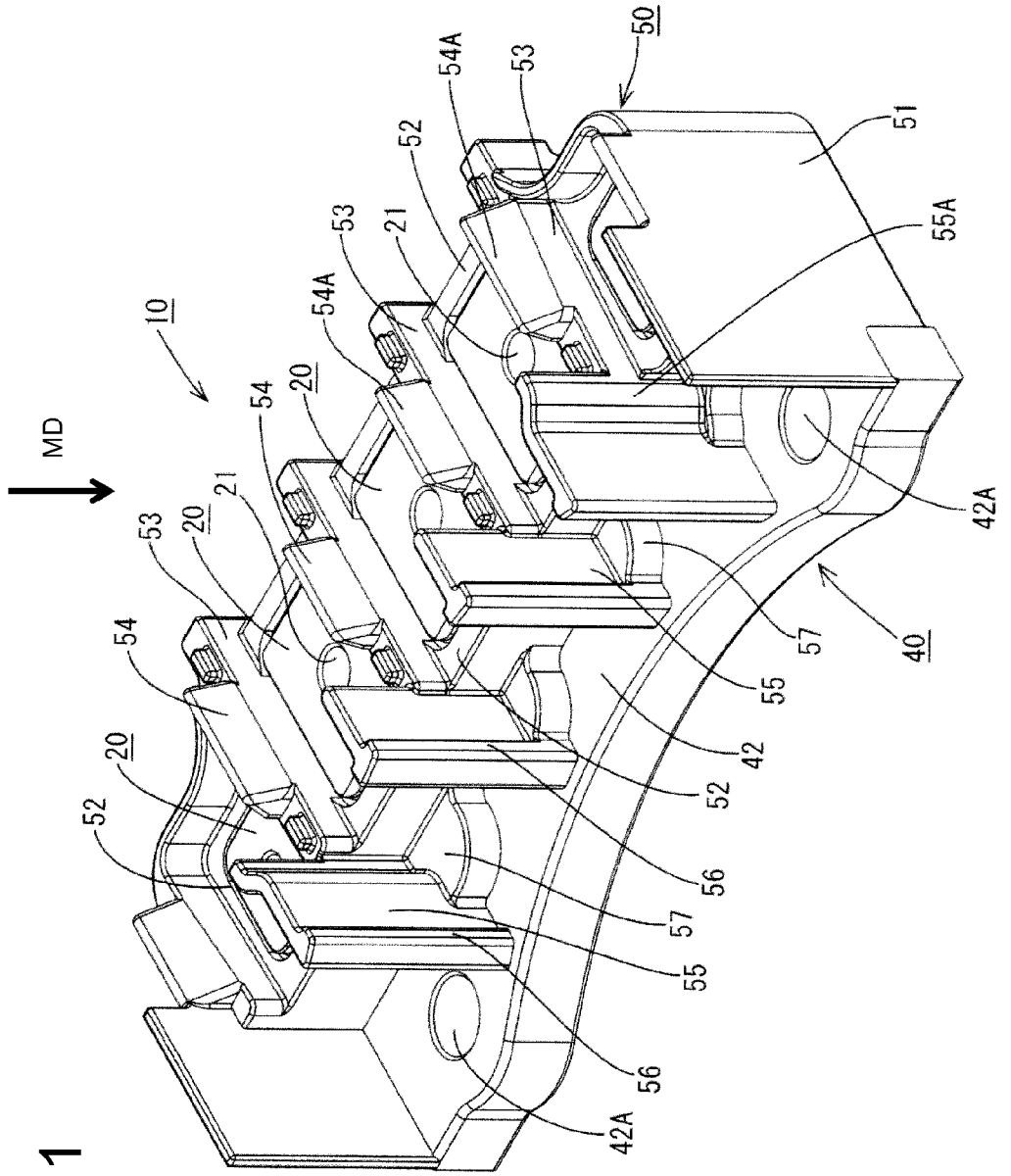


FIG. 1

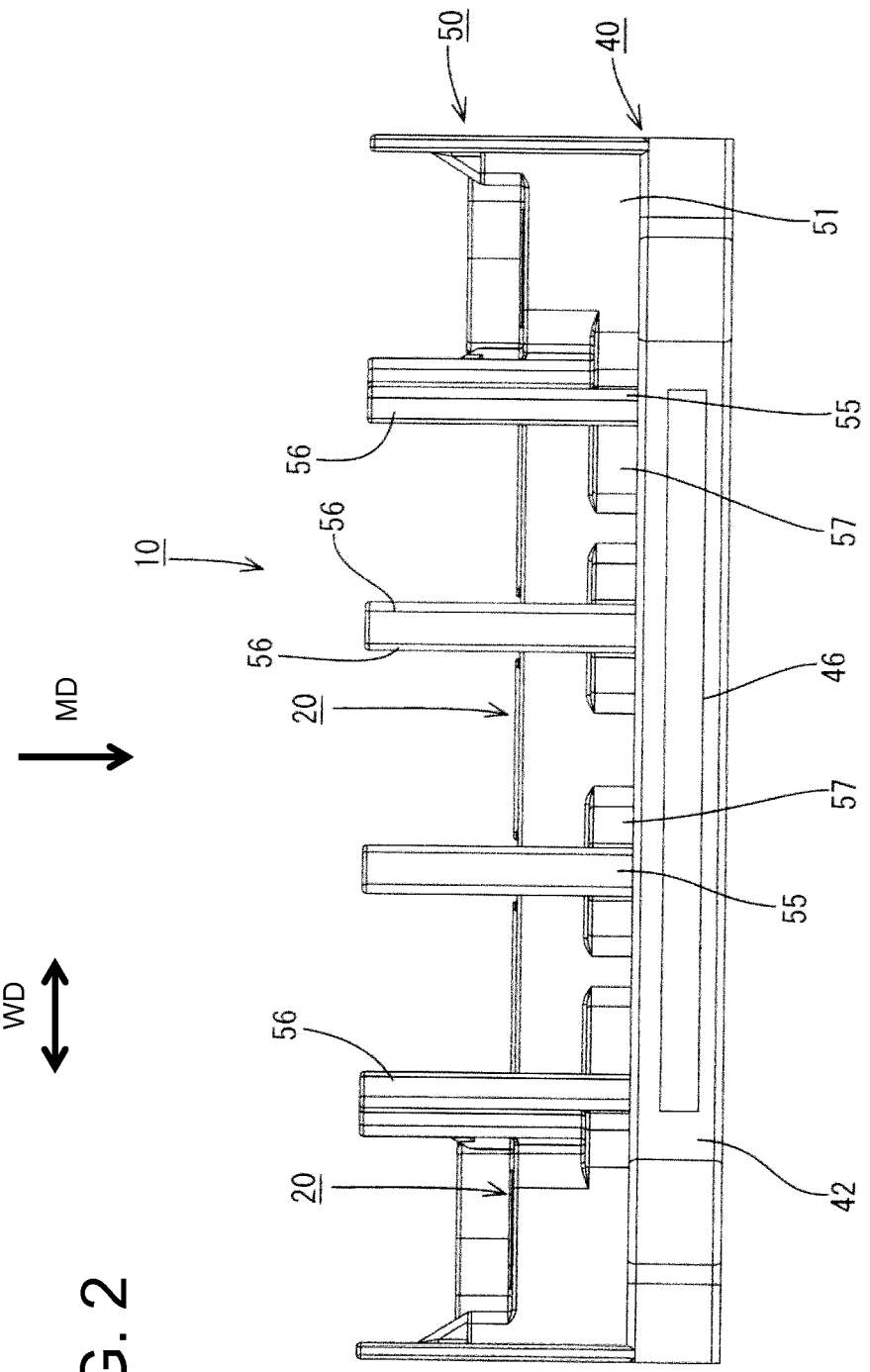
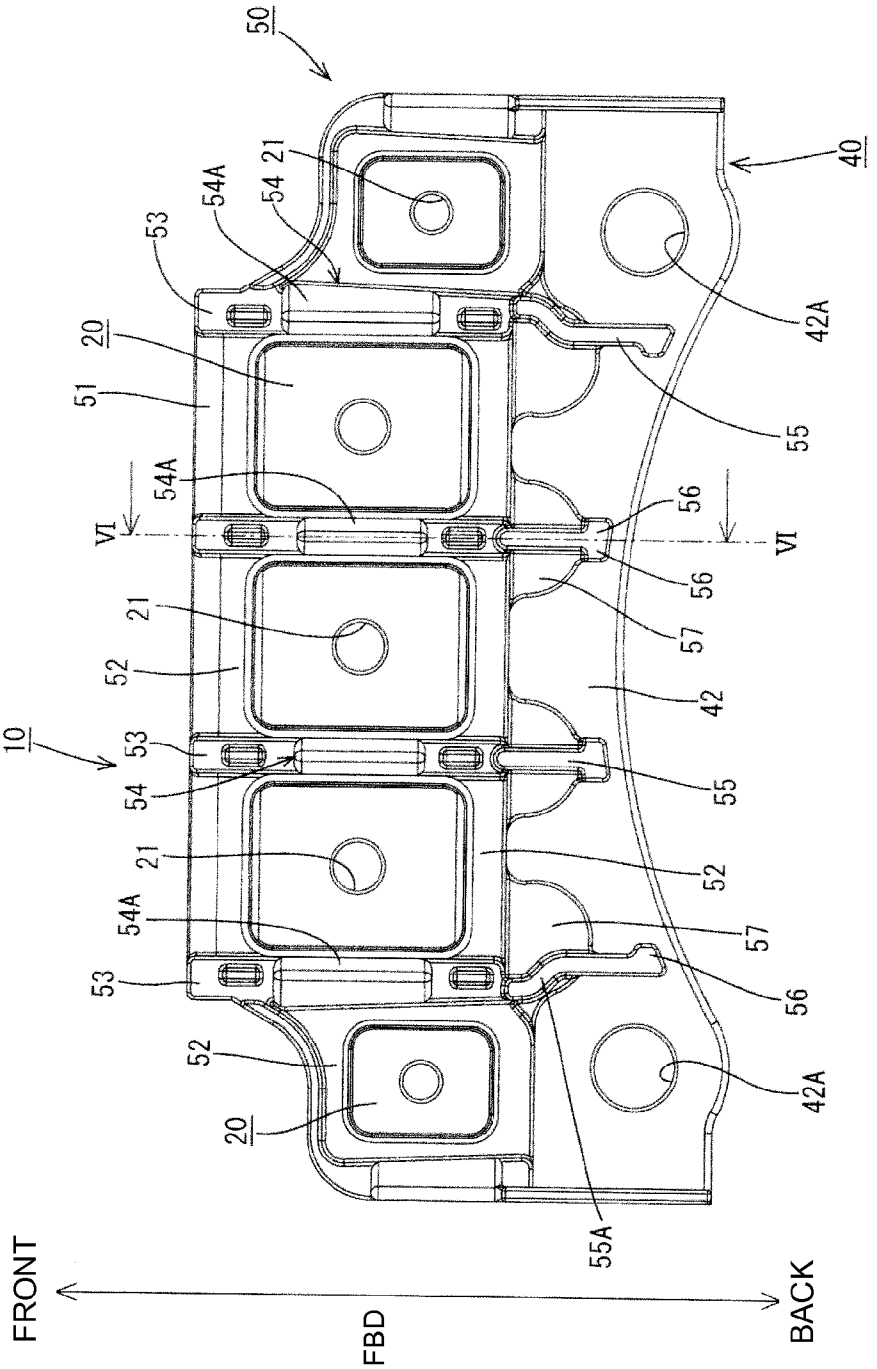


FIG. 2

FIG. 3



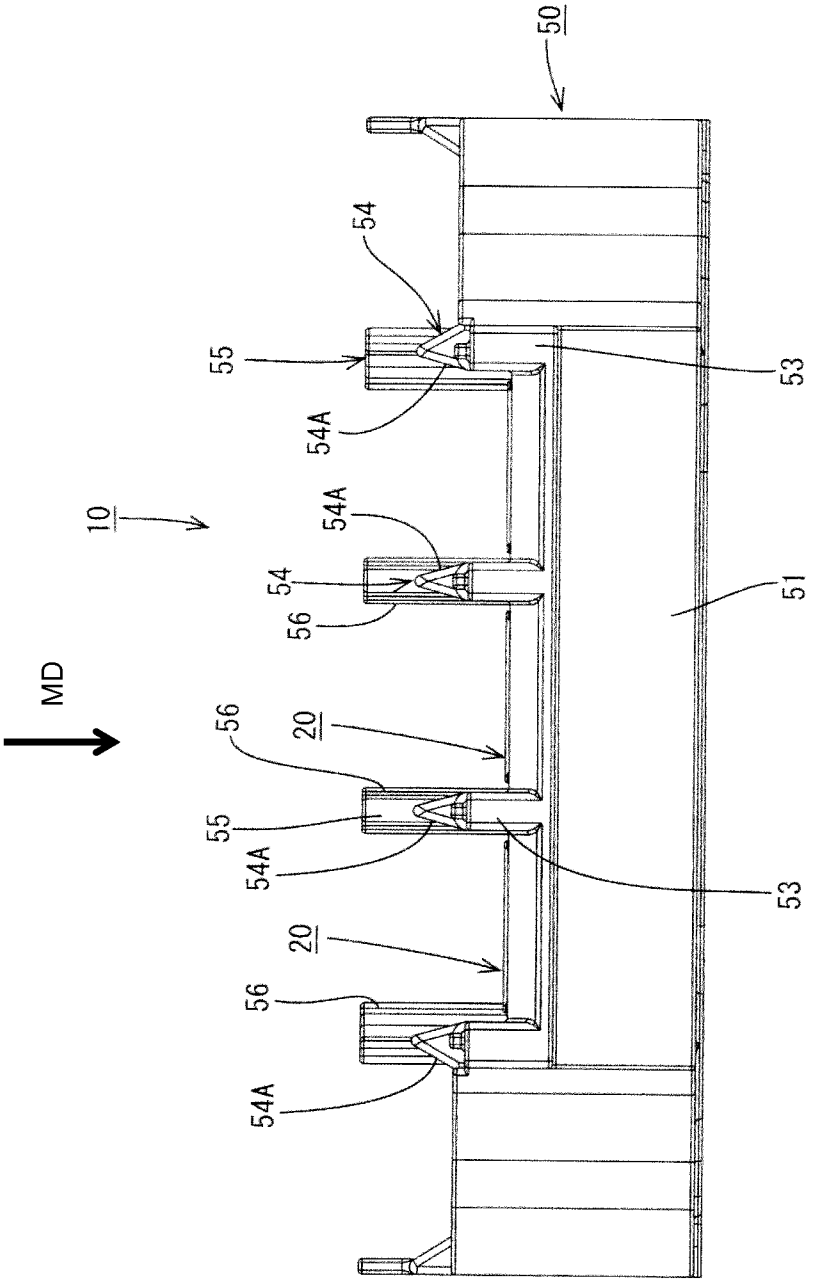


FIG. 4

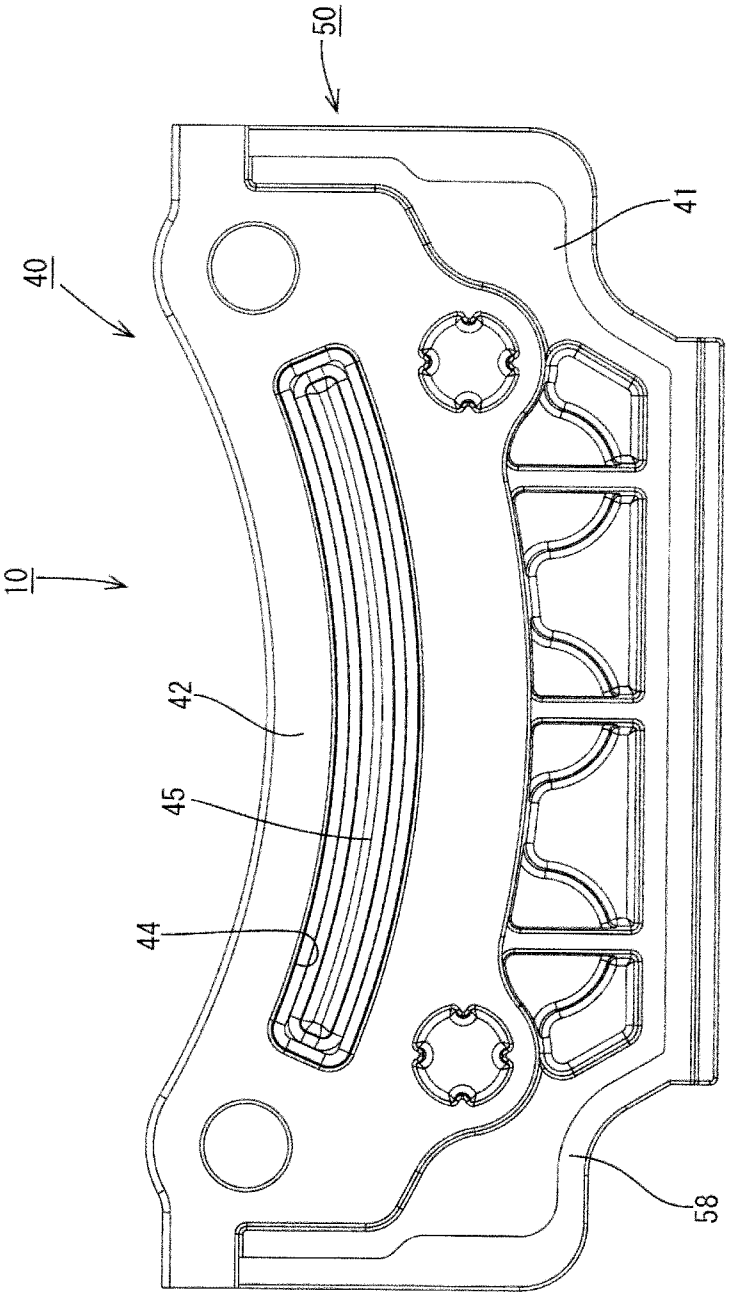


FIG. 5

FIG. 6

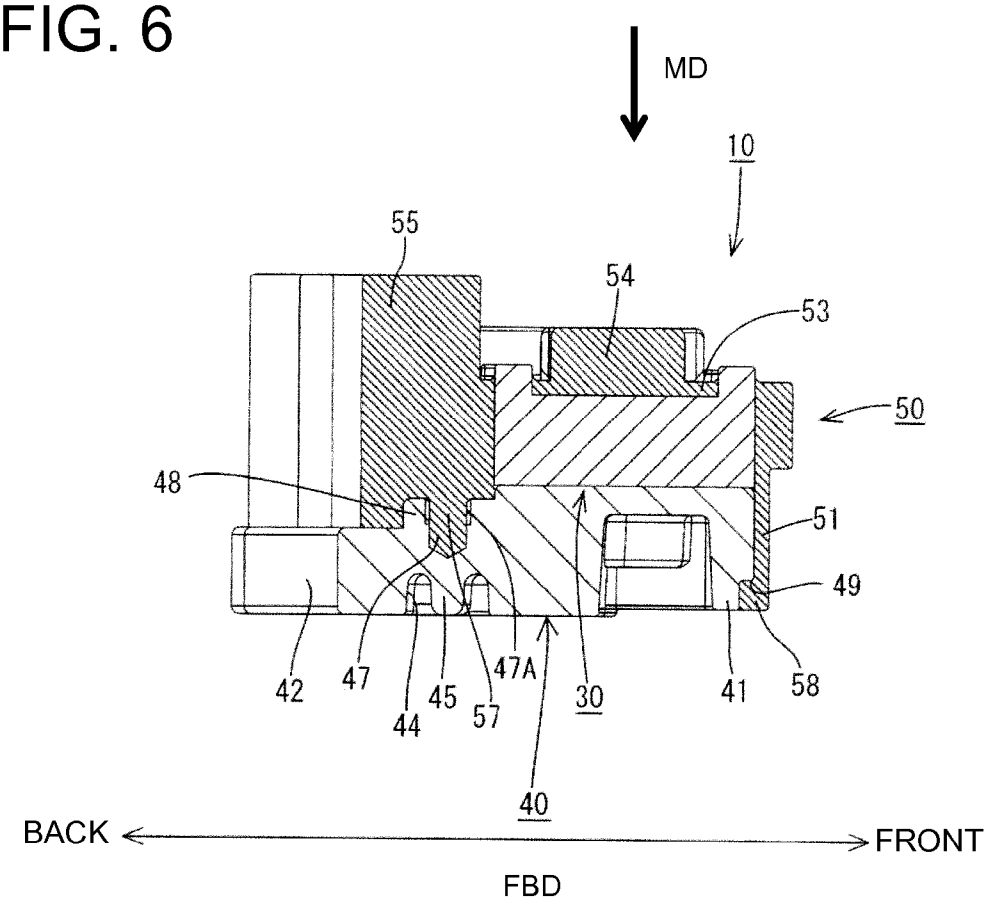
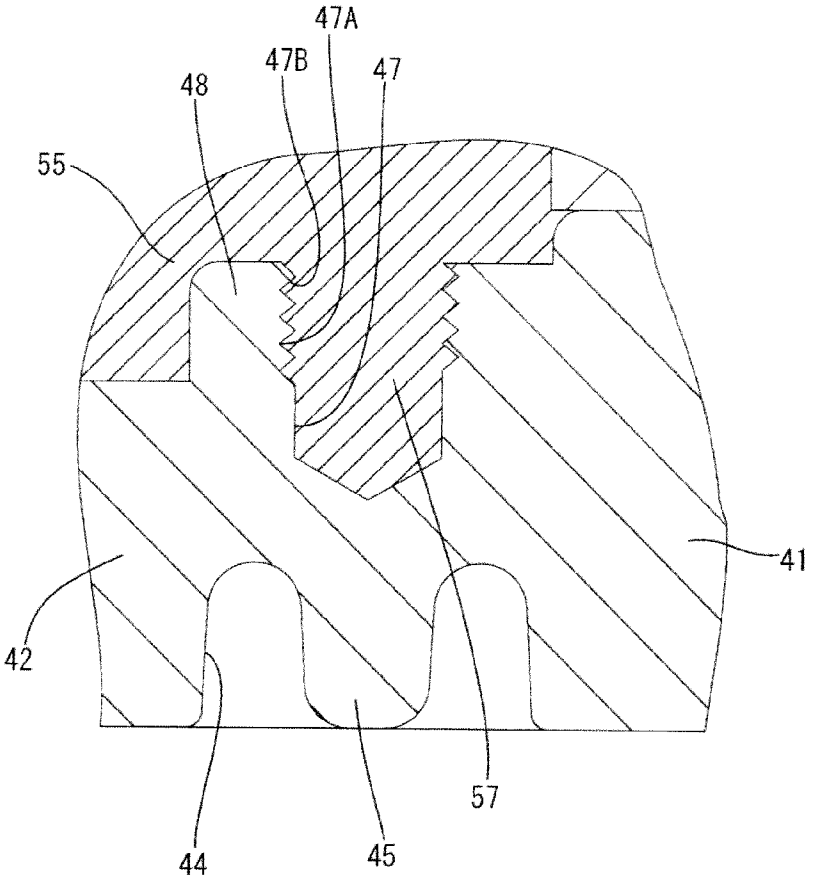

MD
10
55
54
53
50
48
51
49
42
47
44
45
57
47A
30
41
58
40
BACK
FRONT
FBD

FIG. 7



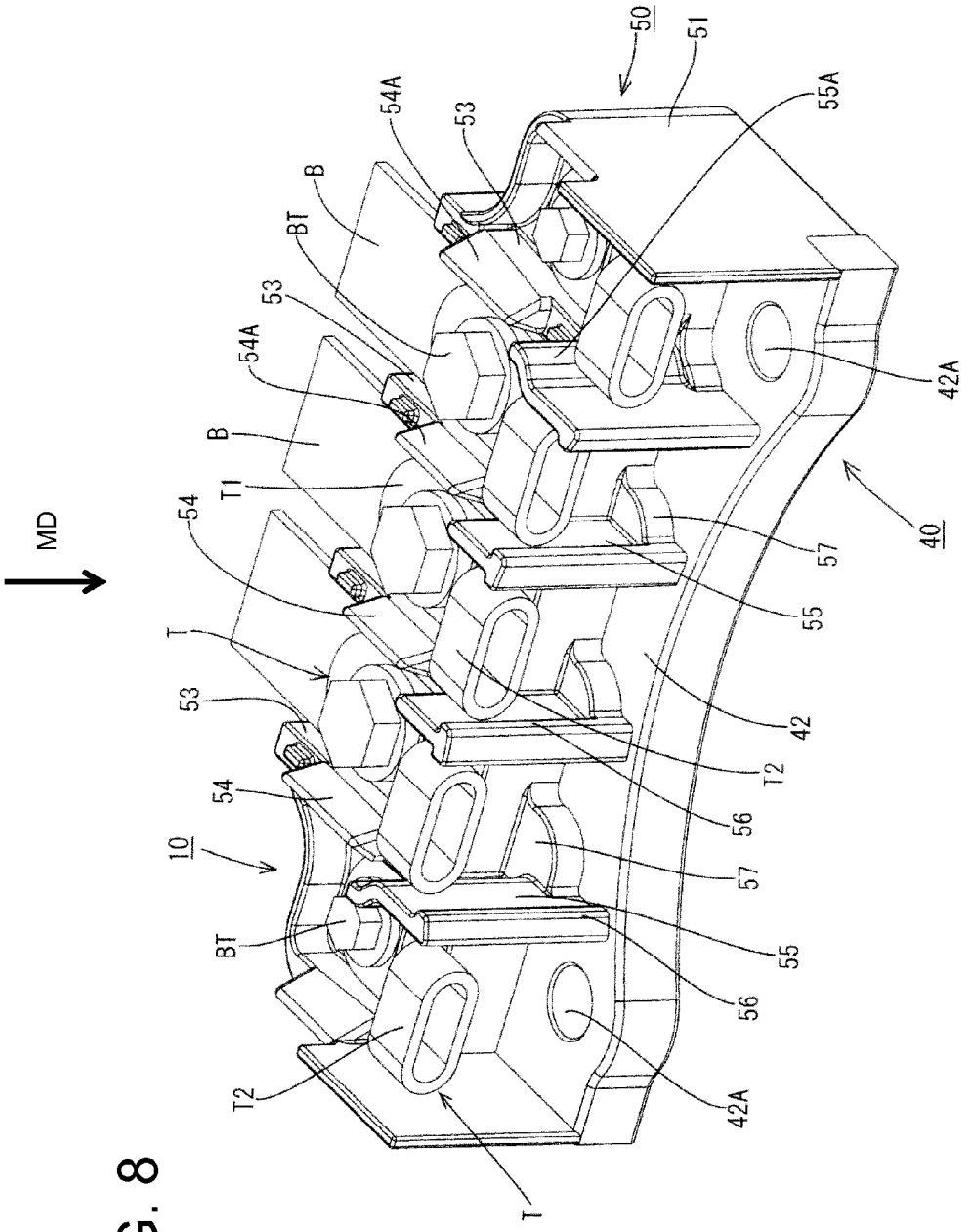

MD
50
51
55A
54A
53
B
BT
53
54A
B
T1
54
T
53
54
10
BT
T2
T
42A
56
55
57
42
T2
56
57
55
42A
40
57
55
42A

FIG. 8

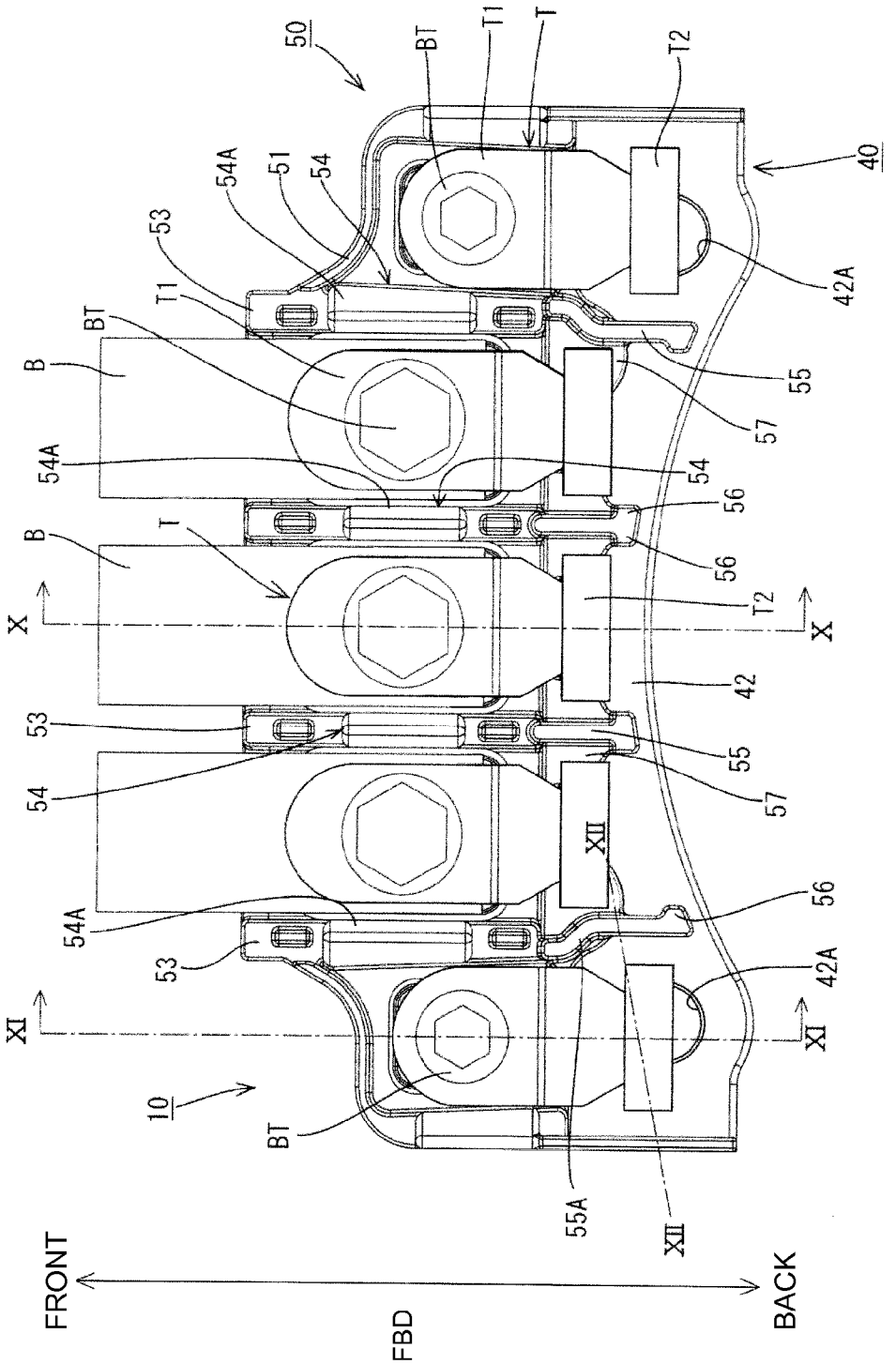

50
BT
T1
T
T2
40
54A
51
54
53
42A
T1
BT
B
55
57
54A
54
56
B
T
56
X
X
T2
42
53
55
54
57
XII
54A
56
53
42A
XI
XI
10
BT
55A
XII
FRONT
BACK
FBD

FIG. 9

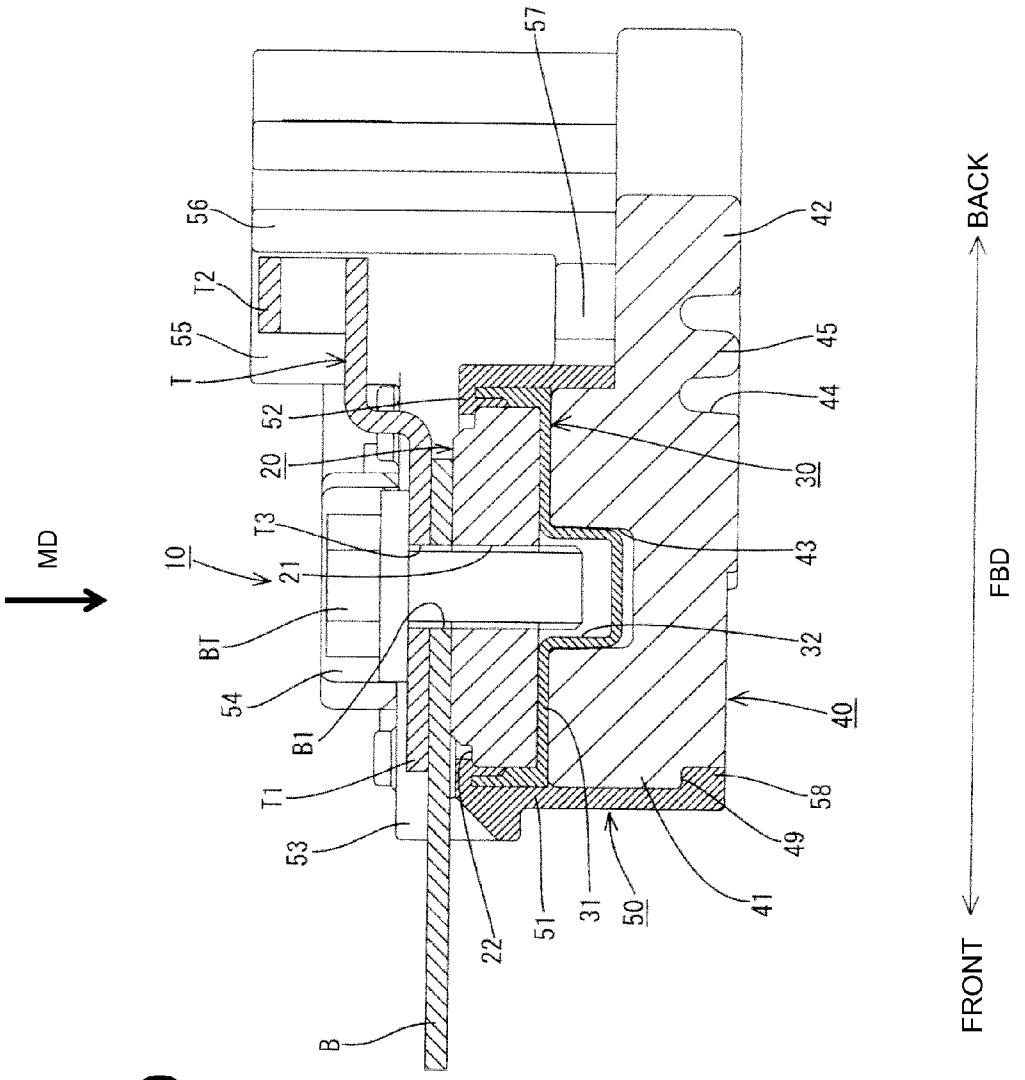

MD
57
56
42
T2
55
45
T
52
44
20
30
T3
43
10
21
B1
32
54
40
B1
T1
58
53
49
22
51
31
50
41
B
BACK
FBD
FRONT

FIG. 10

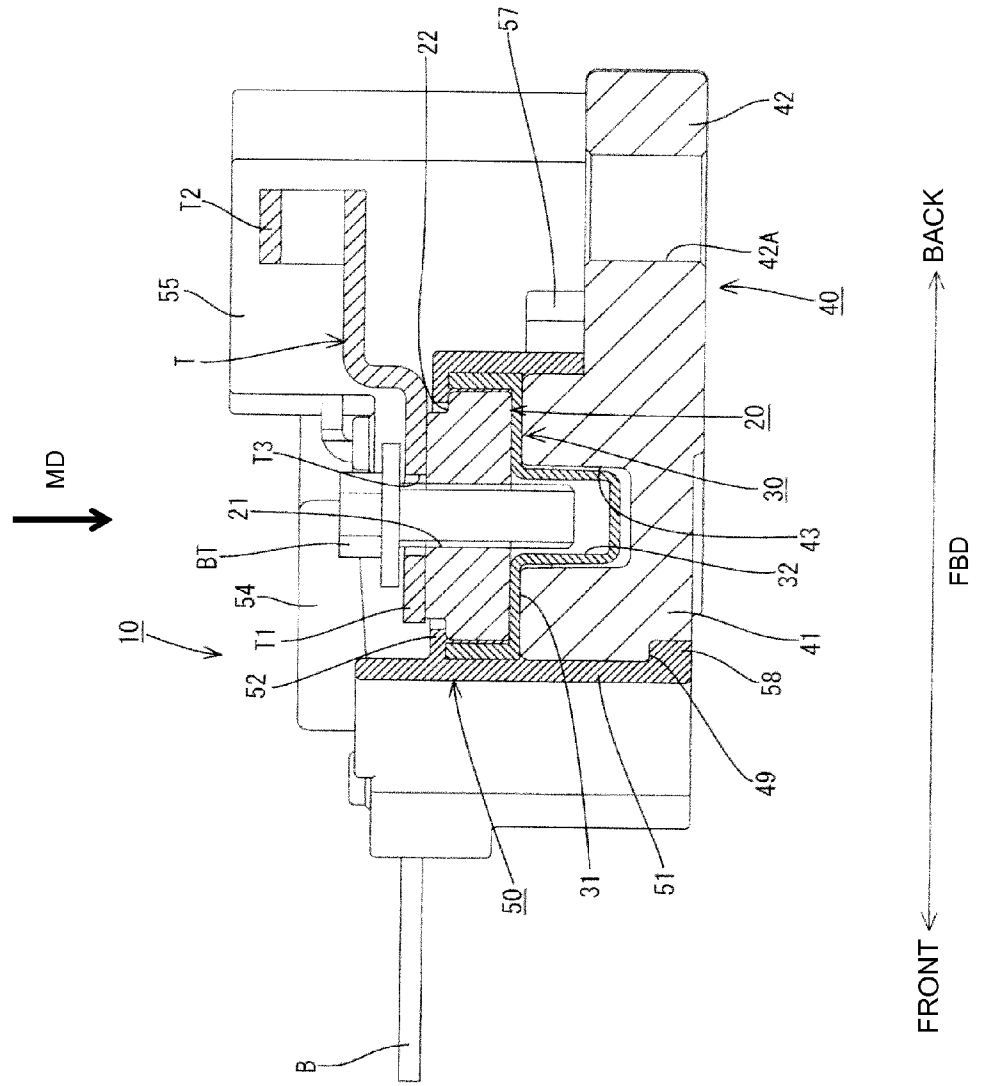

MD
22
57
42
T2
42A
55
40
T
20
T3
30
21
43
BT
32
54
41
10
T1
52
58
49
50
31
51
B
BACK
FBD
FRONT

FIG. 11

FIG. 12

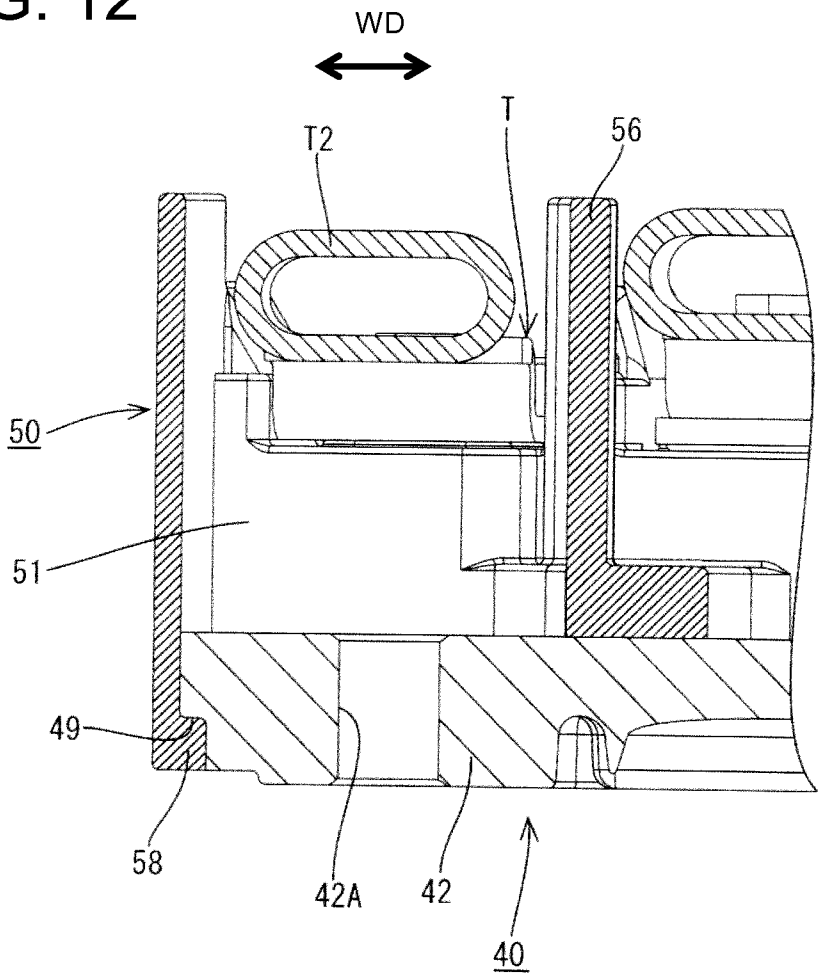
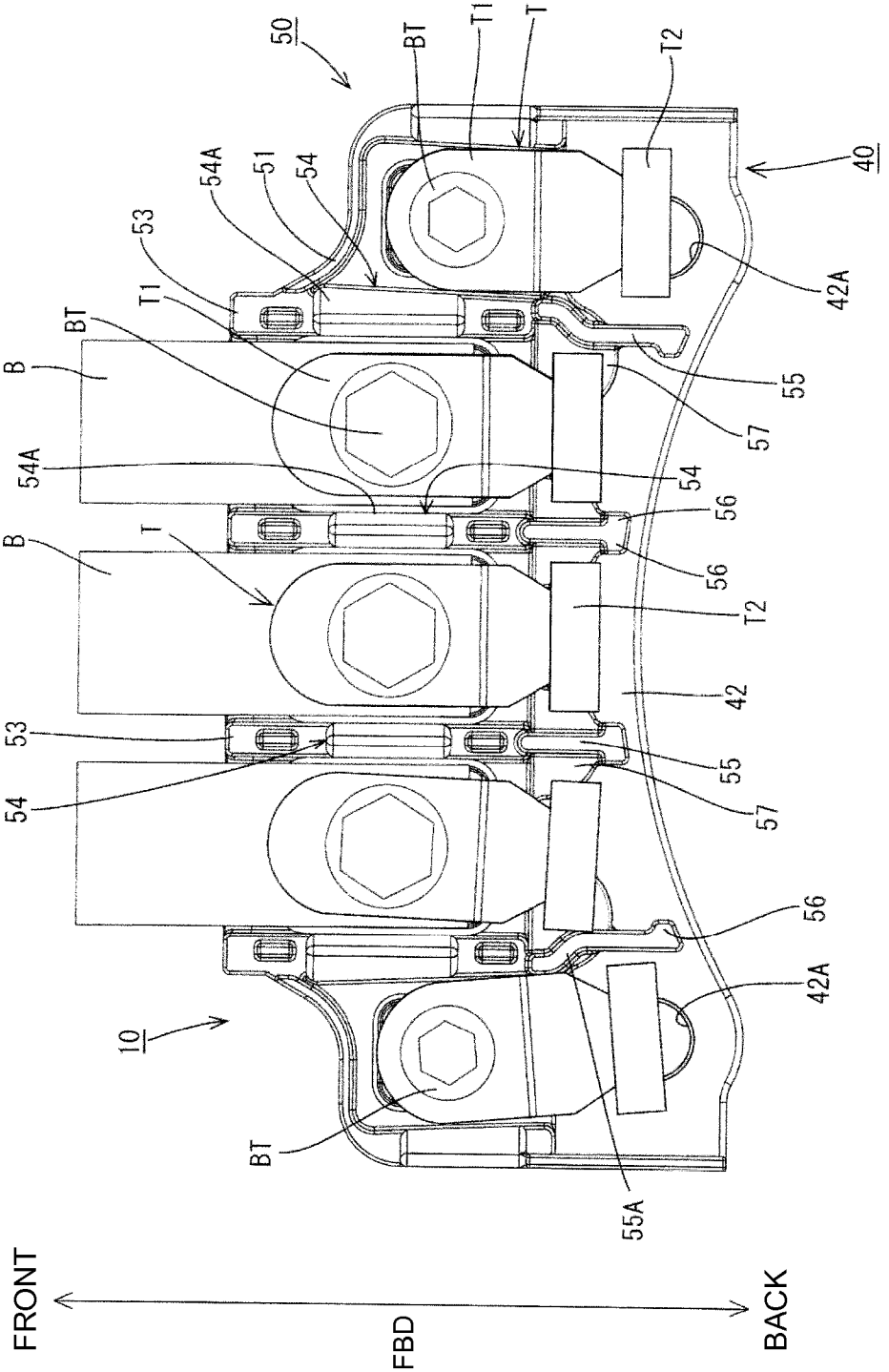


FIG. 13


50
BT
T1
T
T2
40
54A
51
54
53
42A
T1
BT
B
55
57
54A
54
56
B
T
56
T2
42
53
55
54
57
56
42A
10
BT
55A
FRONT
FBD
BACK

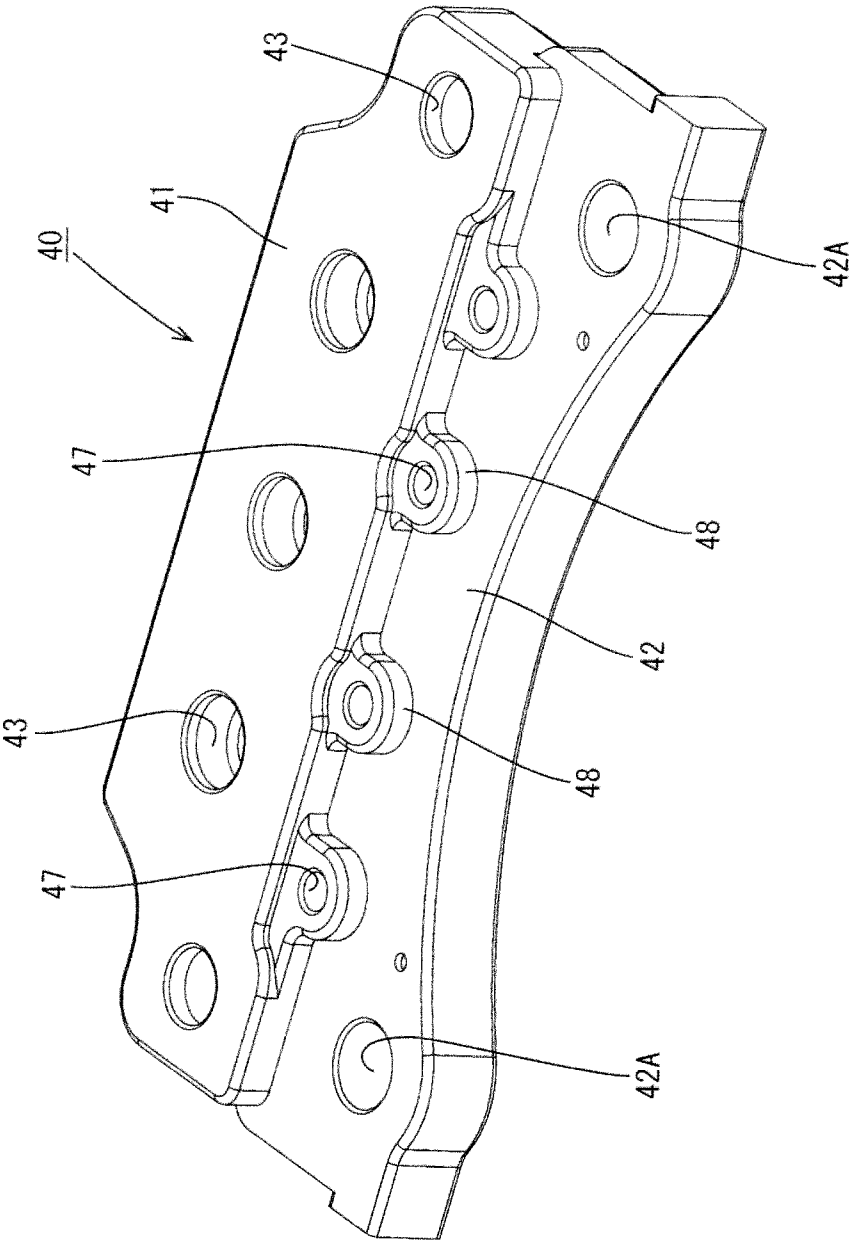


FIG. 14

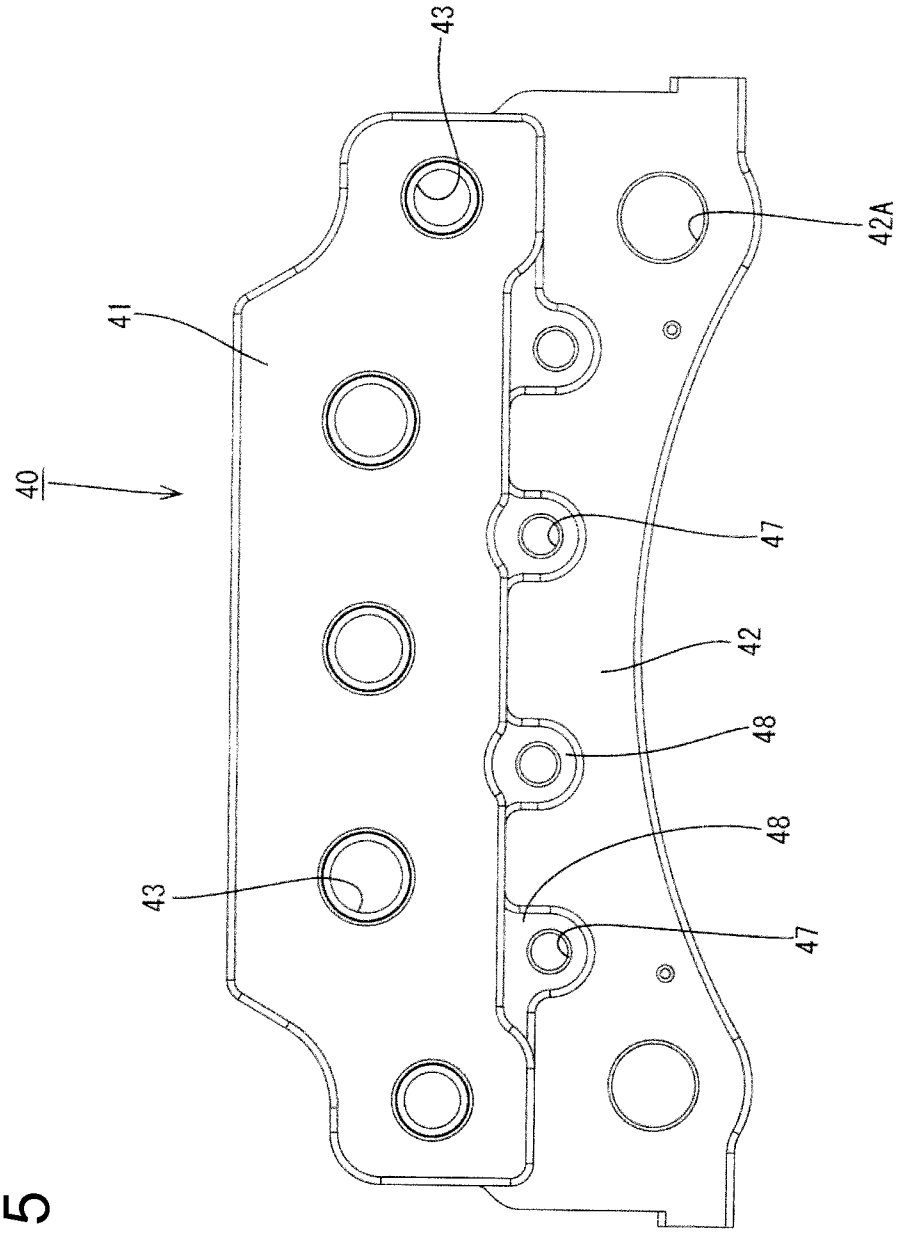
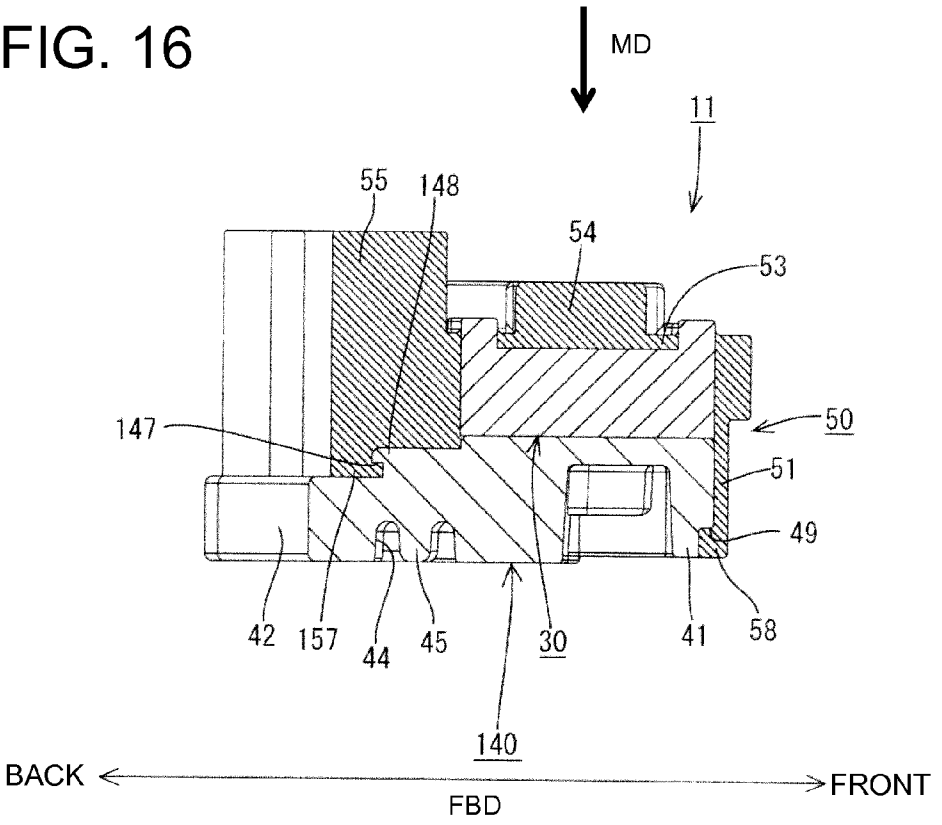


FIG. 15

FIG. 16


MD
11
55
148
54
53
50
147
51
49
42
157
44
45
30
41
58
140
BACK
FRONT
FBD

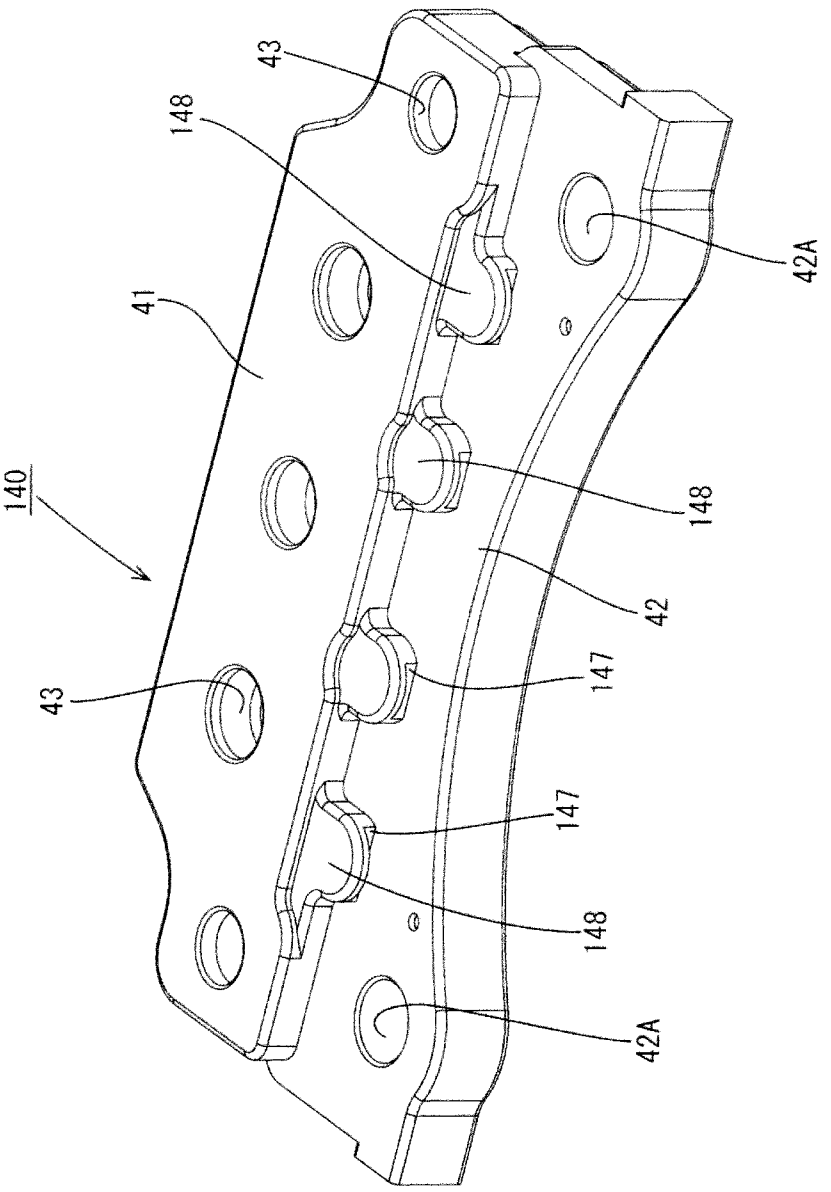


FIG. 17

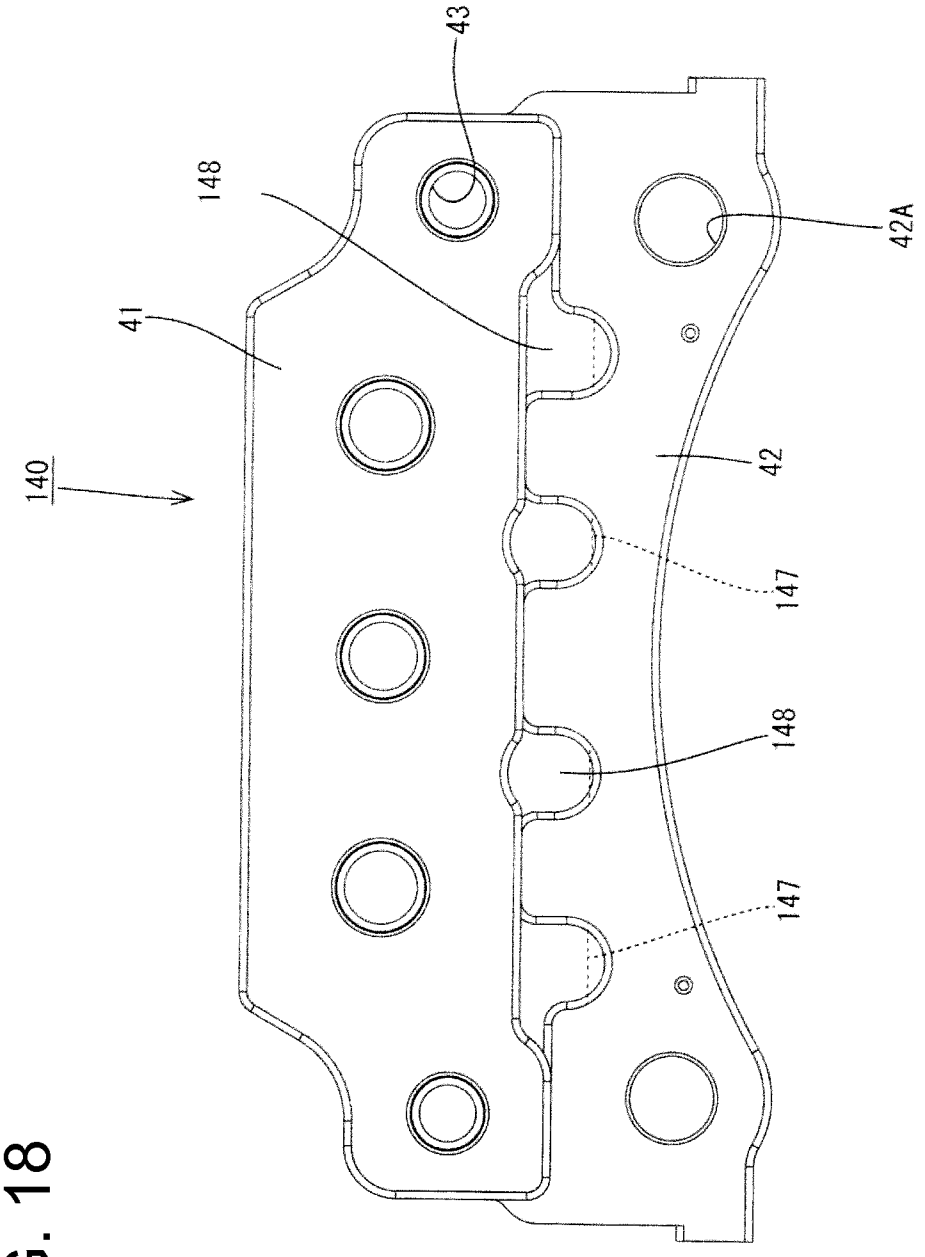


FIG. 18

TERMINAL BLOCK

BACKGROUND

1. Field of the Invention

The invention relates to a terminal block.

2. Description of the Related Art

Japanese Unexamined Patent Publication No. 2012-151038 discloses a terminal block for connecting motor-side busbars extending from a motor and inverter-side busbars extending from an inverter. More particularly, the motor-side busbars and the inverter-side busbars are placed one over the other on a plurality of nuts arranged in a width direction and bolts are inserted through both types of busbars and tightened to connect the busbars electrically.

A conductive member, such as a busbar, in the above-described terminal block may be displaced in the width direction when being placed on the nut or may be displaced rotationally in the width direction following rotation of the bolt as the bolt is tightened. Thus, the conductive member may be fixed in an improper posture. As a result, an insulation distance at which discharge does not occur may not be ensured.

The invention was completed in view of the above situation and an object thereof is to enable bolt tightening while maintaining an insulation distance between conductive members.

SUMMARY OF THE INVENTION

The invention relates to a terminal block for connecting conductive members extending from a device to mating conductive members. The terminal block includes at least one fastening seat configured to fasten the conductive members and the mating conductive members together with at least one bolt. At least one guide is provided adjacent to the fastening seat and is configured to guide the conductive member to the fastening seat by contacting a lateral edge of the conductive member. At least one posture correcting portion is provided at positions where the conductive member is pulled out to outside from the fastening seat and is configured to correct the posture of the conductive members in a width direction by contacting the conductive members pulled out to the outside from the fastening seat in the width direction. Accordingly, the conductive member can be guided to the fastening seat by the guide and the posture of the conductive member in the width direction can be corrected by the posture correcting portion when placing the conductive member on the fastening seat of the terminal block. In this way, it is possible to bolt the conductive member and the mating conductive member while ensuring an insulation distance between the conductive members.

Plural fastening seats preferably are arranged in the width direction and are configured to fasten the conductive members and the mating conductive members together with a plurality of bolts. The at least one guide preferably comprises between adjacent fastening seats.

The terminal block may comprise a bracket to be fixed to a case of the device.

The terminal block further may comprise an insulating plate arranged to be sandwiched by the nut and the bracket. The insulating plate preferably is made of a highly heat conductive synthetic resin containing glass or talc.

The terminal block may further comprise a resin portion that integrally fixes the nuts, the insulating plate and the bracket while holding them one over another in close contact by at least partly covering parts of these members.

A nut locking portion preferably is provided on the resin portion and locks a stepped portion of each nut together with the insulating plate from above. The nut locking portion locks the stepped portion of the nut to prevent a clearance from being formed between the nut and the insulating plate when the bolt is tightened with the nut.

The conductive member preferably includes a bolt fastening portion to be placed on the fastening seat in a mounting direction and a wire fixing portion to be fixed to an end of a wire.

The guides may project between adjacent bolt fastening portions. The posture correcting portions may stand up from the bracket to be arranged adjacent to and between the wire fixing portions. Accordingly, the guides guide bolt fastening portion onto the fastening seat while the posture correcting portions correct the posture of the wire fixing portion in the width direction when placing the conductive member on the fastening seat from above. Further, the disposition of the posture correcting portions between the wire fixing portions to which cores of the wires are to be fixed provides a large creepage distance (insulation distance) between the conductive members.

The posture correcting portion preferably is a plate extending in a pull-out direction in which the conductive member is pulled out.

A projection preferably is on an extending end of each posture correcting portion and projects in the width direction over the entire height of the posture correcting portion. The projection contacts the conductive member in the width direction when the conductive member is displaced with respect to the pull-out direction. The projection also strengthens the posture correcting portion. The conductive member contacts the projection in the width direction if the conductive member is displaced in the pull-out direction. As a result, the posture of the conductive member is corrected to approach a proper posture. Thus, the projection performs a reinforcing function and a posture correcting function, thereby simplifying the structure as compared with the case where a reinforcement and a posture correcting portion are provided separately on the posture correcting portion.

The posture correcting portions may meander in the width direction. The meandering configurations can improve the strength of the posture correcting portions and can suppress inclination of the posture correcting portions in the width direction when the conductive members contact the posture correcting portions or when other members contact the posture correcting portions as compared with the case where the posture correcting portions extend straight in the pull-out direction of the conductive members.

These and other objects, features and advantages of the invention will become more apparent upon reading the following detailed description of preferred embodiments and accompanying drawings. It should be understood that even though embodiments are described separately, single features thereof may be combined to additional embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a terminal block in a first embodiment.

FIG. **2** is a front view of the terminal block.

FIG. **3** is a plan view of the terminal block.

FIG. **4** is a rear view of the terminal block.

FIG. **5** is a bottom view of the terminal block.

FIG. **6** is a section along VI-VI of FIG. **3**.

FIG. **7** is an enlarged section of an essential part of FIG. **6**.

FIG. **8** is a perspective view showing a state where busbars and terminals are bolted in proper postures.

FIG. **9** is a plan view showing the state of FIG. **8**.

FIG. **10** is a section along X-X of FIG. **9**.

FIG. **11** is a section along XI-XI of FIG. **9**.

FIG. **12** is a section along XII-XII of FIG. **9**.

FIG. **13** is a perspective view showing a state where the busbar and the rotated terminal are bolted.

FIG. **14** is a perspective view of a bracket.

FIG. **15** is a plan view of the bracket.

FIG. **16** is a section, equivalent to FIG. **6**, in a second embodiment.

FIG. **17** is a perspective view of a bracket.

FIG. **18** is a plan view of the bracket.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A first embodiment of the invention is illustrated in FIGS. **1** to **15** and includes a terminal block **10** that is to be mounted to a mounting device such as a motor case (not shown) made of conductive material (e.g. metal) and installed in a vehicle such as an electric vehicle or a hybrid vehicle. The terminal block **10** electrically connects terminals T and busbars B. The terminals T are connected to enameled wires (not shown) extending from a connection device, e.g. extending from a three-phase AC motor housed in the motor case. The busbars B extend from the connection device, e.g. from an inverter. Note that, in the following description, a vertical direction is based on that in FIG. **2**, forward and backward directions are based on a vertical direction of FIG. **9**, and a side where the busbars B are arranged (shown upper side) is referred to as a front side.

As shown in FIGS. **10** and **11**, the terminal block **10** has nuts **20** on which the busbars B and the terminals T are to be placed in a mounting direction MD (e.g. from above), a bracket **40** below the nuts **20**, an insulating plate **30** between the nuts **20** and the bracket **40**, and a resin portion **50** for integrally fixing these.

The busbar B is a substantially flat plate that vertically penetrates the bolt insertion hole B**1** in the mounting direction MD at a position to be placed on the nut **20**.

As shown in FIGS. **8** to **10**, the terminal T includes a bolt fastening portion T**1** in the form of a flat plate to be placed on the nut **20** and a barrel T**2** to which enameled wires are to be connected. A connecting part is between the bolt fastening portion T**1** and the barrel T**2** and is cranked so that the barrel T**2** is offset from the bolt fastening portion T**1**. The bolt fastening portion T**1** is formed with a vertically penetrating bolt insertion hole T**3**. Further, the barrel T**2** particularly is in the form of a substantially elliptical tube that is wide in the width direction WD, and substantially opposite widthwise end parts are rounded.

Each nut **20** is made of conductive material such as metal and, as shown in FIG. **3**, has a substantially rectangular plan view. A bolt fastening hole **21** is provided in a central part of each nut **20** and a bolt BT can be tightened therein. The nuts **20** are arranged in the width direction WD. The bolt fastening portion T**1** of the terminal T for power source and the busbar B are placed one over the other on each of the three middle nuts **20**. The bolt BT is inserted through the bolt fastening hole T**3** of the bolt fastening portion T**1** and the bolt insertion hole B**1** of the busbar B and tightened into the bolt fastening hole **21** of the nut **20** so that the terminal T and the busbar B are fastened together and electrically connected by the bolt BT and the nut **20**, as shown in FIG. **10**.

The bolt fastening portion T**1** of the terminal T for neutral point is placed on each of the nuts **20** on the opposite sides from above, the bolt BT is inserted through the bolt insertion hole T**3** of the bolt fastening portion T**1** and tightened into the bolt fastening hole **21** of the nut **20** so that the terminal T for neutral point is bolted to the nut **20** as shown in FIG. **11**.

The barrel T**2** of the terminal T is behind or offset from the nut **20** when the bolt fastening portion T**1** of each terminal T is fixed to the nut **20**.

A step **22** is formed over substantially the entire periphery on an upper peripheral edge of each nut **20**. As shown in FIGS. **10** and **11**, this step **22** is slightly lower than the upper surface of the nut **20** and is covered at least partly by a nut locking portion **52** of the resin **50** from above.

The insulating plate **30** is made of a highly heat conductive synthetic resin containing glass or talc and is sandwiched vertically by the nuts **20** and the bracket **40**, as shown in FIGS. **10** and **11**. A bottom plate **31** is arranged between the nuts **20** and the bracket **40** and is in the form of a thin flat plate. The lower surfaces of the nuts **20** are held in close contact with the upper surface of the bottom plate **31**, and the upper surface of the bracket **40** is held in close contact with the lower surface of the bottom plate **31**. Thus, heat of the nuts **20** is transferred efficiently to the bracket **40** via the insulating plate **30**.

The bottom plate **31** of the insulating plate **30** has bolt escaping recesses **32**, which are bottomed recesses that project down. Each bolt escaping recess **32** substantially corresponds to the bolt fastening hole **21** of the nut **20** arranged on the upper surface of the insulating plate **30**, and prevents interference of the bolt BT and the insulating plate **30** by allowing the tip of the bolt BT to escape when the bolt BT is tightened into the nut **20**.

The bracket **40** is formed by aluminum die casting and, as shown in FIGS. **14** and **15**, wide in the width direction WD. The rear surface of the bracket **40** is formed into a substantially arcuate or bent shape substantially in conformity with the shape of the motor case. As shown in FIGS. **10** and **11**, the bracket **40** includes an embedded portion **41** on which the insulating plate **30** is to be placed and that is covered by the resin **50**. A mounting portion **42** is connected behind the embedded portion **41** and is exposed from the resin portion **50**.

The insulating plate **30** is placed on the upper or outer surface of the embedded portion **41** and covers substantially the entire upper surface of the embedded portion **41**. Fitting recesses **43** are provided substantially side by side in the width direction WD on the upper surface of the embedded portion **41** and receive the bolt escaping recesses **32** of the insulating plate **30**. The insulating plate **30** is to be mounted on the upper surface of the embedded portion **41** without being displaced by fitting the bolt escaping recesses **32** into the fitting recesses **43**.

As shown in FIGS. **10** and **15**, the mounting portion **42** is provided on a lower rear end edge of the embedded portion **41** and is to be fixed to an attaching portion (not shown) on the motor case. As shown in FIG. **3**, through holes **42**A vertically penetrate opposite widthwise sides of the mounting portion **42**. Fixing bolts (not shown) are inserted through the through holes **42**A and tightened into the attaching portion to fix the bracket **40** and the terminal block **10** to the motor case.

As shown in FIGS. **5** and **6**, at least one arcuate heat radiation recess **44** is formed on the lower surface of the mounting portion **42** and extends in the width direction WD. The heat radiation recess **44** is recessed up and at least one cooling fin **45** projects down near the back wall of the heat radiation recess **44**. When the mounting portion **42** is fixed to the attaching portion of the motor case, coolant circulating in the motor case can circulate substantially in the width direction WD in the heat radiation recess **44** and heat of the bracket **40** is efficiently radiated from the cooling fin **45**.

The resin portion **50** is made of synthetic resin and, as shown in FIGS. **10** and **11**, integrally fixes the nuts **20**, the insulating plate **30** and the bracket **40** while vertically holding them one over another in close contact by at least partly covering parts of these members. The resin portion **50** includes a main body **51** that collectively covers side surfaces of the nuts **20**, of the insulating plate **30** and of the embedded portion **41**.

A substantially rectangular nut locking portion **52** is provided on an upper part of the main body **51** and locks the step **22** of each nut **20** together with the insulating plate **30**. The nut locking portion **52** locks the step **22** of each nut **20** from above to prevent a clearance from being formed between the nut **20** and the insulating plate **30** when the bolt BT is tightened into the bolt fastening hole **21** of the nut **20** and the nut **20** is pulled up.

As shown in FIGS. **3** and **4**, partition walls **53** stand up from the main body **51** at positions between adjacent nut locking portions **52** and partition adjacent nuts **20**. Specifically, the partition walls **53** are arranged substantially side by side in the width direction WD and extend over the entire length of the main body portion **51** in forward and backward directions FBD. The height of the partition wall **53** exceeds the sum of the thickness of the bolt fastening portion T**1** of the terminal T and the thickness of the busbar B placed on the nut **20**, as shown in FIG. **10**. Thus, a distance at which insulation is maintained between adjacent bolt fastening portions T**1** and between adjacent busbars B is assured, i.e. a so-called insulation distance (creepage distance).

A guide **54** is provided of an upper end of each partition wall **53** at an intermediate part in forward and backward directions FBD, as shown in FIGS. **3** and **4**, and guides the busbar B and the terminal T with respect to the upper surface of the nut **20**. The guide **54** has a converging or pointed triangular shape that is long in forward and backward directions FBD and has oblique surfaces **54**A on opposite widthwise sides. Thus, the busbar B and the bolt fastening portion T**1** contact the oblique surfaces **54**A of the guides **54** and are guided onto the upper surface of the nut **20** even if the busbar B and/or the bolt fastening portion T**1** of the terminal T are displaced slightly in the width direction WD when placing the busbar B and the terminal T on the upper surface of the nut **20** in the mounting direction MD.

As shown in FIGS. **1** and **3**, a substantially plate-like posture correcting portion **55** extends back from the rear end of each partition wall **53**. The posture correcting portions **55** project up along the mounting direction MD from the upper surface of the mounting portion **42**. The posture correcting portions **55** on opposite widthwise sides meander in the width direction WD at positions near the partition walls **53** as shown in FIG. **3**, thereby forming crank portions **55**A bent toward the center.

As shown in FIG. **9**, the barrels T**2** of the terminals T placed on the nuts **20** are arranged at opposite widthwise sides of the posture correcting portions **55** with clearances defined in the width direction WD therebetween. As shown in FIGS. **10** and **11**, the height of the posture correcting portion **55** exceeds the height of the barrel T**2** located on a rear part of the terminal T, and a rear end part thereof extends more backward than the rear part of the barrel T**2**. When the terminals T are placed on the nuts **20**, the posture correcting portions **55** block between the barrels T**2** of adjacent terminals T to ensure a creepage distance (insulation distance) between adjacent barrels T**2**.

Further, if the terminal T is placed on the nut **20** from above and in the mounting direction MD with the barrel T**2** thereof displaced in the width direction WD, the posture correcting portion **55** contacts a lateral edge of the barrel T**2** in the width direction and corrects the posture of the barrel T**2** in the width direction WD to a substantially proper posture in which the terminal T is straight in forward and backward directions FBD. When the terminals T are placed on the nuts **20**, the adjacent barrel portions T**2** are blocked by the posture correcting portions **55** and the creepage distance (insulation distance) between the barrels T**2** is ensured even if the adjacent barrels T**2** are displaced slightly in the width direction WD, as shown in FIG. **13**.

The terminal T may rotate following the rotation of the bolt BT when tightening the bolt BT into the nut **20**. However, the posture correcting portion **55** contacts the barrel T**2** in the width direction WD to limit rotation of the terminal T and ensuring the creepage distance (insulation distance) between the adjacent barrels T**2**.

At least one projection **56** project substantially in the width direction WD on a rear end part of each posture correcting portion **55** for reinforcement. The projection **56** is formed over the entire height of the posture correcting portion **55** and is behind the barrel T**2** of the terminal T mounted in a proper posture on the nut **20**.

Projections **56** is provided on each of opposite widthwise sides of each of the two posture correcting portions **55** arranged in the intermediate position out of the posture correcting portions **55** to prevent the posture correcting portion **55** from being inclined in the width direction WD and broken when a lateral force acts on the posture correcting portion **55**. Further, one projection **56** is provided on each of the two posture correcting portions **55** arranged on opposite widthwise sides and projects toward the center to cooperate with the crank portion **55**A to reinforce the posture correcting portion **55**. Thus, the two posture correcting portions **55** arranged on the opposite widthwise sides prevent the posture correcting portions **55** from being inclined in the width direction WD to be broken when a lateral force acts on the posture correcting portions **55**.

The strength of the posture correcting portion in the width direction WD could be increased by setting the thickness of the entire posture correcting portion to the thickness of the part where the projecting portions are provided. However, if the thickness of the entire posture correcting portion is increased, the clearance between the posture correcting portion and the barrel becomes smaller. Even a slight displacement of the terminal T in the width direction WD may cause the barrel T**2** to move onto the posture correcting portion when placing the nut **20** on the terminal T. However, the clearance between the posture correcting portion **55** and the barrel T**2** is made larger by thinning the posture correcting portion **55** except at the part where the projections **56**. Thus the barrel T**2** easily can be arranged between the posture correcting portions **55** even if the terminal T is displaced slightly in the width direction WD when being placed on the nut **20**. This can improve mounting operability in placing the terminal T on the nut **20**.

The creepage distance between the barrels of adjacent terminals T may become shorter if the bolt insertion hole T**3** of the bolt fastening portion T**1** is large relative to the bolt BT and the terminal T is bolted in a state slightly displaced backward. However, if the terminal T is displaced backward, the projecting portions **56** contact the barrel T**2** in the width direction WD and the posture of the terminal T can be corrected to approach a proper posture where the terminal T is substantially straight in forward and backward directions FBD. Thus, the required creepage distance (insulation distance) between the barrels T**2** is assured.

The projection **56** has two functions, namely, reinforcing the posture correcting portion **55** and correcting the posture of

the terminal T. Thus, the structure of the posture correcting portion **55** becomes less complicated, as compared with the case where the reinforcing function and the posture correcting function are provide separately.

A first lock **57** is provided on a lower end part of the posture correcting portion **55** and engages a bottomed screw hole **47** provided on the mounting portion **42**.

The screw hole **47** of the mounting portion **42** has a screw groove **47**A on the inner peripheral surface and is formed by recessing the upper surface of a substantially cylindrical build-up portion **48** projecting from the upper surface of the mounting portion **42**.

As shown in FIG. **7**, the first lock **57** enters the screw hole **47** of the mounting portion **42** and the screw groove **47**A of the screw hole **47** by covering the build-up portion **48** of the mounting portion **42**. The first lock **57** locks an upper end **47**B of the screw groove **47**A from below when an upward pulling force acts on the resin portion **50**. Thus, the main body **51** of the resin portion **50** and the embedded portion **41** of the bracket **40** cannot be separated at a rear end of the resin portion **50** when the bolt BT is tightened into the bolt fastening hole **21** of the nut **20** and the resin portion **50** is pulled up together with the nut **20**.

Further, the first locking portions **57** and the screw holes **47** particularly are arranged substantially between adjacent nut locking portions **52**, and two nut locking portions **52** are supported by one first locking portion **57** and one screw hole **47**. That is, e.g. five nut locking portions **52** are supported by four first locking portions **57** and e.g. four screw holes **47** on the rear end side of the resin portion **50** and the numbers of the first locking portions **57** and the screw holes **47** can be reduced as compared with the case where the first locking portion is formed for each nut locking portion. This can prevent the bracket **40** and the resin portion **50** from being separated while simplifying the structure of the rear end side of the resin portion **50**.

The screw holes **47** are arranged in correspondence with and above the heat radiation recess **44** of the mounting portion **42** and formed in the build-up portions **48** on top of the mounting portion **42** so that a sufficient thickness is ensured between the heat radiation recess **44** and the screw holes **47**.

Although a screw hole is formed by cutting using a drill or the like, it is generally not possible to form a screw groove with a tip part of the drill. Hence, the depth of the screw hole is larger than the height of a part where the screw groove is provided. Thus, if it is attempted to form a screw hole with a predetermined dimension of a screw groove ensured above a heat radiation recess without providing a build-up portion on a mounting portion, a sufficient thickness cannot be ensured between the heat radiation recess and the screw hole and the screw hole cannot be provided above the heat radiation recess. However, the screw hole **47** is formed in the build-up portion **48** provided on top of the mounting portion **42**. Thus, the heat radiation recess **44** and the screw hole **47** can be formed vertically one above the other on the mounting portion **42** while ensuring a sufficient thickness between the heat radiation recess **44** and the screw hole **47**. Thus, the mounting portion **42** is not enlarged as compared with the case where the mounting portion and the heat radiation recess are displaced in forward and backward directions.

On the other hand, as shown in FIGS. **6**, **10** and **11**, a second locking portion **58** is provided on a lower end part of the main body **51** for locking an engaging portion **49** connected to a lower outer peripheral edge part of the embedded portion **41** and opposite lower lateral edges of the mounting portion **42** from below.

The engaging portion **49** is stepped to be raised slightly from the lower surface of the bracket **40** and is recessed slightly inward of the outer peripheral surfaces of the embedded portion **41** and the mounting portion **42**.

The second locking portion **58** is formed on an outer peripheral edge of the main body portion **51** except at a front edge part of the main body **51** to correspond to the engaging portion **49**, and at least partly covers the engaging portion **49** from below. That is, as shown in FIG. **5**, the second locking portion **58** is substantially U-shaped in bottom view and surrounds the embedded portion **41** over substantially the entire circumference together with the first locking portions **57** of the main body portion **51**.

Specifically, the first and second locking portions **57**, **58** of the main body **51** lock the bracket **40** from below in such a manner as to surround the embedded portion **41** over substantially the entire circumference and reliably prevent the resin portion **50** and the bracket **40** from being separated vertically.

To prevent the separation of a resin portion and a bracket, it is thought to provide a stepped engaging portion over the entire circumference on a lower outer peripheral edge part of the bracket and lock the engaging portion over the entire circumference from below by a locking portion of a main body portion by covering the side surfaces of the bracket and the engaging portion over the entire circumference by the resin portion. However, a heat radiation property of the bracket may be reduced if the outer peripheral surface of the bracket is covered over the entire circumference with resin. Further, a gate mark **46** formed when the bracket **40** is formed by die casting may be left on the rear surface of the mounting portion **42**. If that gate mark **46** is covered with resin, the resin portion may be broken, such as due to the formation of cracks from fine edge parts formed on an outer peripheral edge part of the gate mark **46**.

However, the mounting portion **42** is exposed from the resin portion **50** according to this embodiment. Thus, the resin portion **50** will not break while a heat radiation property of the bracket **40** is improved.

The busbars B extending from the connection device (such as the inverter) are placed on the upper surfaces (mounting surfaces) of the nuts **20** of the terminal block **10** mounted and fixed to the mounting device (such as the motor case) and, then, the terminals T connected to ends of the enameled wires extending from the mounting device (particularly the motor) are placed on the busbars B.

The busbars B may be displaced slightly in the width direction WD when the busbars B are placed on the nuts **20** from above and in the mounting direction MD. However, the lateral edges of the busbars B contact the oblique surfaces **54**A of the guides **54** and the busbars B are guided and placed onto the upper surfaces of the nuts **20**. Further, even if the terminals T are displaced slightly in the width direction WD, the lateral edges of the bolt fastening portions T**1** of the terminals T contact the oblique surfaces **54**A of the guiding portions **54** and the terminals T are guided and placed onto the upper surfaces of the nuts **20** similarly to the busbars B.

Further, in the case of the terminal T, even if the barrel T**2** is displaced in the width direction WD due to rotational displacement of the terminal T in the width direction WD, the posture correcting portion **55** contacts the lateral edge of the barrel T**2** in the width direction WD so that the posture of the barrel portion T**2** in the width direction WD is corrected and the terminal T is placed on the nut **20** in a state where adjacent barrels T**2** are blocked by the posture correcting portion **55**.

The busbar B and the terminal T can be guided onto the nut **20** by the guiding portion **54** and the posture of the barrel T**2** of the terminal T can be corrected by the posture correcting

portion **55** when the busbar B and the terminal T are placed on the nut **20**. Thus, the terminal T and the busbar B can be placed on the nut **20** while ensuring the creepage distance (insulation distance) between adjacent barrel portions T**2**.

The posture correcting portion **55** corrects the posture of the terminal T by contacting the barrel T**2** of the terminal T, and it is necessary to prevent the posture correcting portion **55** from being inclined in the width direction WD to be broken. It is thought to increase the thickness of the entire posture correcting portion to prevent the inclination of the posture correcting portion. However, if the thickness of the posture correcting portion is increased, the clearance between the posture correcting portion and the barrel becomes smaller and even only a slight displacement of the terminal T in the width direction WD may cause the terminal T to move onto the posture correcting portion, so that operability in mounting the terminal T on the nut **20** is reduced.

However, the projections **56** are provided only on the rear part of each posture correcting portion **55** and a part of the posture correcting portion **55** where the barrel T**2** is arranged is thinner. Thus, the barrel T**2** easily can be arranged between adjacent posture correcting portions **55** even if the barrel T**2** is displaced slightly in the width direction WD. This can improve operability in mounting the terminal T on the nut **20** while ensuring the strength of the posture correcting portion **55** in the width direction WD, as compared with the case where the thickness of the entire posture correcting portion is increased.

The bolt BT then is inserted through the busbar B and the bolt insertion hole T**3** of the bolt fastening portion T**1** and tightened into the bolt fastening hole **21** of the nut **20**.

The terminal T may try to rotate with the bolt BT when tightening the bolt BT into the nut **20**. However, the posture correcting portion **55** contacts the barrel T**2** in the width direction WD to prevent the terminal T from rotating.

Further, in case of plural terminals T, a distance between adjacent terminals T may become shorter and the creepage distance (insulation distance) cannot be ensured if the bolt insertion hole T**3** of the bolt fastening portion T**1** is large relative to the bolt BT and the terminal T is displaced slightly backward. However, the projecting portions **56** contact the barrel T**2** in the width direction WD and the posture of the terminal T can be corrected to approach the proper posture in which the terminal T is straight in forward and backward directions FBD if the terminal T is displaced backward. This can reliably ensure the creepage distance (insulation distance) between the barrels T**2**.

When the bolt BT is tightened completely into the bolt fastening hole **21** of the nut **20**, the busbar B and the bolt fastening portion T**1** are fastened together and electrically connected by the bolt BT and the nut **20**.

In the process of tightening the bolt BT into the nut **20**, the resin portion **50** is pulled up together with the nut **20** and the bracket **40** fixed to the mounting device (e.g. the motor case) and the resin portion **50** may be separated. However, the first locking portions **57** lock the upper ends **47**B of the screw grooves **47**A in the screw holes **47** provided on the mounting portion **42** from below on the rear edge of the main body portion **51** of the resin portion **50** and the second locking portion **58** locks the engaging portion **49** from below on the front edge and the opposite widthwise side edges of the bracket **40**. Specifically, the first and second locking portions **57**, **58** provided on the main body **51** of the resin portion **50** lock the embedded portion **41** from below and surround the embedded portion **41** over substantially the entire circumference. Thus, the bracket **40** and the resin portion **50** cannot separate.

A second particular embodiment of the present invention is described with reference to FIGS. **16** to **18**.

In a terminal block **11** of the second embodiment, the shapes of the build-up portions **48** and the first locking portions **57** of the first embodiment are changed. Configurations, functions and effects similar or common to the first embodiment are not repeatedly described. Further, the similar or same components as those of the first embodiment are denoted by the same reference signs.

Build-up portions **148** of a bracket **140** of the second embodiment are provided with one or more cuts **147** extending in the width direction WD instead of the screw holes. The cuts **147** are recessed forward from the rear end surfaces of the build-up portions **148**.

On the other hand, first locking portions **157** of the second embodiment cover the build-up portions **148** from above and enter the cuts **147** from behind. When a resin portion **50** is pulled up, the first locking portions **157** lock the cut portions **147** from below.

When forming vertically recessed cuts in build-up portions, it is thought to form the cut portions in the respective build-up portions individually, for example, using a cutting tool such as a drill, but as many cutting processes as the build-up portions are necessary. However, the cuts **147** of this embodiment can be formed in the build-up portions **148** by cutting the build-up portions **148** straight in the width direction, for example, using a cutting tool such as a T-shaped cutter. This can simplify the cutting process as compared with the case where the cuts are cut individually vertically, for example, using a drill or the like.

The invention is not limited to the above described embodiments. For example, the following embodiments also are included in the scope of the invention.

The busbar B and the terminal T are connected electrically in the above embodiments, but terminals may be electrically connected to each other.

Although the coolant of the motor case is circulated in the heat radiation recess **44** in the above embodiments, the present invention is not limited to such a mode. For example, the entire lower surface of the mounting portion may be held in close contact with the motor case to radiate heat of the bracket to the motor case without providing the radiation recess on the lower surface of the mounting portion.

Although the nut has a substantially rectangular plan view in the above embodiments, the present invention is not limited to such a mode. For example, the nut may have a substantially circular or elliptic plan view.

Although the nuts **20** for neutral point are provided on the opposite widthwise sides of the terminal block **10**, **11** in the above embodiments, the invention is not limited to such a mode. For example, the nut for neutral point may be provided only on one side.

What is claimed is:

1. A terminal block for connecting conductive members extending from a device and mating conductive members, comprising:

a bracket to be fixed to a case of the device;

at least one nut configured to fasten at least one of the conductive members and at least one of the mating conductive members together with at least one bolt;

an insulating plate sandwiched between the nut and the bracket, the insulating plate being made of a highly heat conductive synthetic resin containing glass or talc;

at least one guide provided adjacent to the nut and configured to guide the conductive member to the nut by contacting a lateral edge part of the conductive member; and

a resin portion that integrally fixes the nuts, the insulating plate and the bracket while holding them one over another in close contact, the resin portion including a nut locking portion for each nut, the nut locking portion locking a step of the nut together with the insulating plate from above to prevent a clearance from being formed between the nut and the insulating plate when the bolt is tightened with the nut, at least one posture correcting portion provided at one or more positions where the conductive members are pulled out to outside from the nut and configured to correct postures at least one of the conductive members in a width direction by contacting at least one of the conductive members pulled out to the outside from the nuts in the width direction.

2. The terminal block of claim **1**, wherein the at least one nut comprises plural nut arranged in the width direction and configured to fasten the conductive members and the mating conductive members together with a plurality of bolts, and the at least one guide comprises guides between adjacent ones of the fastening seats.

3. The terminal block of claim **1**, wherein the conductive member includes a bolt fastening portion to be placed on the nut in a mounting direction and a wire fixing portion to be fixed to an end of a wire.

4. The terminal block of claim **3**, wherein the guide projects adjacent to the bolt fastening portion and between adjacent bolt fastening portions; and

wherein the posture correcting portions stand up from the bracket to be arranged at least partly between the wire fixing portions.

5. The terminal block of claim **1**, wherein the posture correcting portion is a plate extending in a pull-out direction of the conductive member.

6. The terminal block of claim **1**, wherein a projection projects in the width direction over an entire height of the posture correcting portion on an extending end part of each posture correcting portion.

7. The terminal block of claim **6**, wherein the projection is configured to contact the conductive member in the width direction when the conductive member is displaced with respect to a pull-out direction.

8. The terminal block of claim **7**, wherein the posture correcting portions are not planar.

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